

ENVIRONMENT

ABSTRACT

The environmental industry segment occupies a strategic position at the crossroads of security, stability, and prosperity. The industry's goods and services have significant implications for the welfare of individuals and the activities of governments. Unfortunately, the US environmental industry is stagnant, with declining growth and revenues. In order to revive this industry, governments must move beyond compliance-based regulatory programs to find ways to incentivize business to exceed the minimum standards. In addition, we must all begin to consider the national security implications inherent in protection of the environment. Globally, the health of the environmental industry, and of the environment itself, depends on the world's embracing the concept of sustainable development: using the environment today while preserving its use for future generations.

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INTRODUCTION

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”ⁱ

It is axiomatic that the environment is critical to the survival of the human race. Unfortunately, for much of its history mankind has taken the environment for granted, using its resources as needed without regard to the effect on future generations. Not until the last half of the twentieth century did serious environmental movements begin to spring up around the world. With these movements, an understanding of the need for sustainable development, as defined above, began to take hold.

Given the importance of the environment, and the need for sustainable development, the environmental industry segment occupies a strategic position at the crossroads of security, stability, and prosperity. The industry’s goods and services have significant implications for the welfare of individuals and the activities of governments. Further, it belongs to a distinct group of industries that directly affect future prosperity by facilitating responsible development and consumption of finite global resources while protecting the environment.

This paper provides an overview of the environmental industry divided into two main parts. The first part focuses on the domestic industry – it defines the environmental industry; analyzes the roles governments play; assesses the economic factors affecting the industry; looks at technological development in the industry; and discusses environmental management systems. The second part of the paper takes a global view, providing regional overviews of the state of the environment and the environmental marketplace.

DEFINING ENVIRONMENTAL INDUSTRY

The environmental industry is notoriously difficult to define. The Organization for Economic Co-operation and Development (OECD) provides the following:

Eco-industries . . . may be described as including firms producing goods and services capable of measuring, preventing, limiting or correcting environmental damage such as the pollution of water, air, soil, as well as waste and noise-related problems. They include clean technologies where pollution and raw material use is being minimized.ⁱⁱ

The US Department of Commerce’s definition is:

. . . all revenue-generating activities associated with (1) compliance with environmental regulations; (2) environmental assessment, analysis, and protection; (3) pollution control, waste management, and remediation of contaminated property; (4) provision and delivery of the environmental resources of water, recovered materials, and clean energy; and (5) technologies and activities that contribute to increased energy and resource efficiency, higher productivity, and sustainable economic growth (enabling pollution prevention).ⁱⁱⁱ

It is obvious from these definitions that the term “environmental industry” covers a lot of ground cutting across numerous industry sectors.

At the industry’s core, however, is a group of identifiable goods and services used to clean-up existing processes and production (“end of pipe” equipment and/or technologies), treat

effluents, control air quality and reduce noise.^{iv} Additional areas of concentration include firms associated with waste management and recycling, mitigation of environmental “scarring,” and research/engineering services.

Environmental Business International’s (EBI) organization of the market into fourteen segments has become the environmental industry’s universally accepted standard for classification used by government and private parties alike. (See the chart at Appendix 1 for a list and brief description of the fourteen segments.) Characterization of each segment is in terms of the range of products and services offered, market size, past and future growth, the number of companies participating in the segment and a list of top firms during a comparative time-period.^v Organization of these fourteen segments is according to one of three groupings based upon whether activities provide services, equipment, or resources. Comparative data originates from the annual revenue surveys of over 1300 companies and from public sector sources.

Market Factors

Several large companies dominate a few of the segments, but for the most part, market composition is largely defined by small to medium sized companies. The majority of revenues come from companies that generate less than \$100M, with many reporting annual revenues of less than \$5M.^{vi}

The Global Outlook

The US remains most competitive in the service segment of the public sector whereas our foreign competitors control most of the private, equipment based industries, a sector that demonstrates tremendous revenue generation potential. The \$453B global environmental market is growing faster than the global economy and is outpacing growth in the US environmental market.^{vii} Many US companies are looking overseas due to this growth potential. Currently, the US environmental industry generates only 9% of its revenues from international sales.^{viii} Although the industry has enjoyed a trade surplus, the rate of export growth has slowed significantly over the past ten years, whereas our competitors have exceeded 20% growth annually.^{ix}

With this description of the environmental industry as a baseline, we turn to a discussion of the role of government in the development and continued growth of the industry.

THE ROLE OF GOVERNMENT

The environmental laws passed in the 1970s are supposed to protect us from lead in our drinking water, hazardous waste in our rivers, and dirty air. Those laws serve as the foundation of what we now call the “environmental industry.” The government created federal and state agencies to enforce these laws, monitor compliance, and punish violators.

Federal Government

The growth of the environmental movement in the 1960s^x was not lost on the politicians of the day. From Kennedy to Nixon, US Presidents added environmental issues and concerns to their platforms. In 1969, Congress passed the National Environmental Policy Act (NEPA), which rewrote the government's role regarding the environment – from *conservator* of the wilderness to the *protector* of earth, air, land, and water.^{xi} Key among NEPA's provisions was a requirement for all federal agencies to submit "Environmental Impact Statements" for any project that could impact the environment. It also directed establishment of a Council on Environmental Quality. In 1970, President Nixon decided to "establish an autonomous regulatory body to oversee the enforcement of environmental policy."^{xii} On December 4, 1970, he established the federal government's chief environmental regulator and enforcer, the Environmental Protection Agency (EPA).

While the EPA is the primary organization charged with protecting the environment, environmental issues and concerns cut across all federal government agencies, requiring significant interagency coordination and cooperation. In order to fulfill its mission, the EPA is structured with an agency headquarters in Washington DC, supported by ten regional offices and more than a dozen labs throughout the country. In both its 2003 Strategic Plan and Budget Summary for FY 2005, the EPA lays out five overarching goals for the coming years: clean air and global climate change, clean and safe water, land preservation and restoration, healthy communities and eco systems, and compliance and environmental stewardship.

State Government

Although the EPA is the chief environmental regulator on paper, the real enforcers are the state environmental agencies. Congress intended that the vast majority of national environmental laws be "delegated" to the States. This means that the State assumes partial or total control over a particular environmental program.^{xiii} According to the Environmental Council of the States (ECOS), over 75% of the federal environmental programs have been delegated to the States.^{xiv} However, delegation does not totally remove the federal government from oversight of the delegated programs. EPA retains the right to review State actions to ensure appropriateness and consistency. In some cases, EPA may overrule a State's environmental decision and initiate an "overfiling."^{xv} Enforcement of environmental law (both delegated federal law and their own state law) remains the States' primary focus. According to data compiled by ECOS, the States conduct about 90% of all enforcement actions.^{xvi} In 1999, the States monitored more than 1.75 million sites, up from 980,000 in 1995.^{xvii}

"New Environmentalism"

In the middle 1980s, environmentalists began to see benefits to focusing environmental policies not on government management, but on property rights and market-oriented incentives. At the same time, private industry and government began to see connections between environmental compliance and economic interests. Had overzealous environmentalists and their allies in Congress gone too far? Were excessive environmental regulations and laws now encroaching on social liberties, personal freedoms, and individual/business economic interests? At some point, excessive government regulation has a negative impact on economic growth. The

consensus among environmentalists, business, and government was that the time had come for a different approach – “new environmentalism.”

At a National Press Club luncheon in April 1992, then EPA Administrator William Reilly called new environmentalism, “an approach which relies on free market incentives and innovative regulations as opposed to strict command and control rules.”^{xviii} Central to this concept is cooperation between government and business and the notion of cost effectiveness. Instead of being an “either-or” proposition, environmental compliance can be a “win-win.” Eventually, organizations will see compliance with environmental laws and regulations as second nature – a normal course of doing business.

So-called “old environmentalism” was punitive in nature and focused on punishment. It raised consciousness, but at the same time led to conflict between the regulators and those being regulated. It relied on the “Four Ps: *prescription*, telling you how you’re supposed to do things; *process*, a focus on the permit you need to ‘pass go’ rather than the result; *punishment* as a way to motivate action; and a *piecemeal* approach to air, land, and water.”^{xix} In contrast, new environmentalism focuses on creating incentives for people and businesses. Former Interior Secretary Gale Norton said this new approach focuses on the “Four Cs: conservation through communication, cooperation, and consultation.”^{xx}

The EPA has adopted this new paradigm and has instituted a variety of programs to encourage compliance with environmental laws. Key among these programs is the National Environmental Performance Track, or “Performance Track” for short. According to former EPA Administrator Christine Todd Whitman, “Performance Track is a voluntary public-private partnership that encourages continuous environmental improvement through the use of environmental management systems, local involvement, and measurable results.”^{xxi} Launched in June 2000, the program strives to show that economic prosperity and environmental protection are not mutually exclusive. It is designed to reward top environmental performers, specifically those that consistently meet environmental regulatory guidance and have implemented effective environmental management systems (EMS).^{xxii} (We discuss EMS in more detail below.)

The EPA offers a variety of benefits for companies who sign up for Performance Track. In addition to the obvious public recognition of being recognized as a business that cares about the environment, Performance Track offers unique networking opportunities for companies to share ideas and innovations with each other and regional administrators. More importantly, Performance Track companies receive lower priority for EPA routine inspections. The vast majority of EPA’s annual inspections are routine and normally occur when there is no reason to believe a company is in violation of any specific environmental regulation. The theory is that companies who have qualified for Performance Track are good environmental stewards and therefore represent a lower risk of being regulatory violators. For the company, fewer inspections mean less time and resources dedicated to preparing for inspections. The only drawback to this incentive is that it applies to EPA inspections only – states are not bound to honor this benefit. The EPA is working with state agencies to encourage them to reduce routine inspections for members. It has signed a number of Memoranda of Agreement with states indicating their intention to work together to recognize and reward Performance Track members.

In order for Performance Track, and other “new environmentalism” programs to really show results, governments must continue to seek new and innovative ways to provide businesses incentives to participate.

Business and Technology Development

Government also must play a key role in the development of the environmental marketplace and of new technology. The “Environmental Technologies” section of the paper, below, discusses government involvement in technology development. What else should government do to aid the environmental industry?

A 1998 Department of Commerce report cited three key actions that environmental industry leaders believed government must take: reform the system of environmental policies and regulations at all levels; make the government a better buyer of environmental products and services; and create “technology-stimulating policies in regulations and R&D programs.”^{xxiii} These recommendations remain relevant and government should pursue their implementation. Most importantly, as stated in the Commerce report, governments should seek approaches that “make greater use of incentives and rewards, information, more flexible regulatory processes, encouragement for innovation, and fiscal and tax policy reforms . . . This will [result] in a more efficient market, which will, in turn, better attract investment and growth capital to the environmental industry, as well as financing for its projects”^{xxiv}

To this point, we have defined the industry, briefly examined its historical development, and discussed the changing roles government must play if the industry is to continue to grow. Now we turn to a discussion of the current economic status of the industry.

ECONOMICS OF THE ENVIRONMENT

The current economic model for the US environmental industry may be described as one dominated by a “command and control” system that discourages innovation and makes the use of innovative technologies difficult. There are few economic incentives for firms to use resources efficiently or go beyond the standards. This situation contributes to the US environmental industry being ill prepared to succeed outside a regulated market both domestically and internationally. Ironically, the success of governmental regulation that created the demand for the environmental industry is now the very same force that may be serving to undermine it.

The Domestic Environmental Market

The US environmental industry produced \$220B in revenues in 2002 representing 2.1% of the US economy.^{xxv} It has remained at 2.1% for the past two years after it peaked in 1990 at 2.6%. Growth ranged between 10% and 15% in 1985-90 and declined to 1%-5% between 1991 and 1996. Since 1991, the average annual return of the Environmental Business Journal Index of 240 companies is 6% as compared to NASDAQ (22%), Dow Jones (16%), and S&P 500 (14%) over the same time. Venture capital in environmental technology fell from more than \$200M in 1991 to less than \$20M in 1996. Investment in research and development for new products and services is very low and concentrated in only half of the industry, mainly from insufficient capital for investment. *Environmental Business Journal* (EBJ) reports that companies shy away from producing new technologies because of the so-called “Valley of Death.” (See the chart at Appendix 2.) Because of a lack of capital in this industry, few firms have the resources to move a new idea from the research and development (R&D) phase to commercial production.^{xxvi}

The relatively recent “flatness” of the market stems from its maturity after heavy consolidation over the past two decades. Firms that were unable or unwilling to diversify ended

up being the targets for those who expanded into new markets and financing. However, the United States environmental industry is the world's largest and comprises 30,000 private and 80,000 public firms employing 1.4 million Americans. The majority of the public sector specializes in regional waste and water treatments producing one-third of industry revenues.

International Environmental Markets

The global environmental market is \$560B; US firms account for \$220B of this revenue. In terms of global environmental technology competitiveness, "the US is considered a world leader in areas such as engineering, design and construction services; water treatment; air pollution control, solid and hazardous waste management; contaminated site remediation; automation for treatment systems and monitoring equipment; and instruments and information systems that use the internet."^{xxvii} While the US has maintained a positive environmental technology trade surplus (1995-2001), the rate of export growth has declined over the same period. In general, the market has remained relatively flat except where driven by regulation or substantial economic benefit. However, analysts currently believe that the US should be able to increase its environmental technology growth rate and exports through continued industry consolidation, the introduction of new technologies and processes into the global market place, and focusing more attention on developing and key international markets.

Despite significant advantages, the US still faces two rather formidable obstacles in the international market – foreign governmental assistance and relatively high tariffs on environmental technology products. According to the US Department of Commerce (USDOC), foreign governments devote significantly more resources and provide more aggressive trade support and financing for environmental technology. This support most commonly comes in the form of tied-aid, subsidization of trade events, and embedding officials and non-officials in the purchasing process.

The USDOC reports that the US environmental technology industry faces "relatively high tariffs on environmental products averaging 15-20% in most markets and...as high as 40% in China, the Philippines, Malaysia, and Brazil. Numerous non-tariff barriers (NTB's) including standards issues affect worldwide trade in environmental technology goods, but are particularly onerous concerning the environmental services trade."^{xxviii} In an effort to reverse this trend, the US Government and environmental trade associations are pursuing trade liberalization within multilateral trade groups such as the World Trade Organization (WTO) as well as multilateral and bilateral free trade agreements. "The WTO Ministerial Declaration issued at Doha pays particular attention to the issue of Trade and Environment. It singles out the ET sector and calls for negotiations on the reduction, or as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services."^{xxix} These measures can enhance US environmental technology and global competitiveness by reducing barriers to competition and increasing free trade.

Green Financing

The domestic public and private sectors as well as international organizations are developing many innovative ways to tie economic incentives with environmental improvement. While there appears to be no collaborative effort, deliberate information sharing, or coherent strategy, mechanisms such as international grants,^{xxx} financing partnerships,^{xxxi} and "green bonds"^{xxxii} appear to be growing trends.

Another key to the economic success of this industry is the continuing development of new technologies. The next section discusses efforts in this area.

ENVIRONMENTAL TECHNOLOGY

The National Science and Technology Council (NTSC) defines an environmental technology as one that advances sustainable development by reducing risk, enhancing cost effectiveness, improving process efficiency, and creating products and processes that are environmentally beneficial or benign.^{xxxiii} In this definition, the word “technology” is specifically intended to include hardware, software, systems, and services. A similar definition may be found in the United Nations Environment Program, *Agenda 21*, which defines an “environmentally sound technology” as one which protects the environment, is less polluting, uses all resources in a more sustainable manner, recycles more products and wastes, and handles residual wastes in a more acceptable manner than the technologies they replace.^{xxxiv} As defined, environmental technology crosses all economic sectors and has the potential to cut costs, increase efficiency, reduce resource consumption, and eliminate harmful emissions and hazardous waste.

The broad field of environmental technology is commonly subdivided into four general categories: Pollution Avoidance often referred to as Pollution Prevention or P2, Pollution Control, Pollution Monitoring and Assessment, and Pollution Remediation and Restoration. Briefly summarized below, these sub-categories broadly define the scope of today’s environmental technology industry.

Pollution Prevention: As defined by the NTSC, pollution prevention technologies are those that avoid the production of environmentally hazardous substances or alter human activities in ways that minimize damage to the environment. Differentiated from “pollution control” technologies by their level of process integration and the elimination of hazardous waste, pollution prevention technologies and processes are designed to treat, destroy, or recycle hazardous materials.

Pollution Control: Pollution control technologies collect hazardous waste for disposal or render hazardous substances harmless before they enter the environment. Equipment and systems for reducing emissions from stationary sources, vehicles, and products and services such as pumps, chemicals, and systems for waste and sludge treatment and disposal are representative of typical pollution control technologies. Because these processes tend to collect hazardous by-products or harmful materials, pollution control technologies are often a primary contributor to the solid/hazardous waste management market. While the market is generally trending toward greater use of pollution prevention technologies as a means to reduce the costs associated primarily with hazardous waste management, it is envisioned that pollution control technologies will continue to offer innovative solutions to assist business compliance with environmental regulation well into the future.

Pollution Monitoring and Assessment: The Environmental Science and Technology Policy Institute defines monitoring and assessment technologies as those used to establish and monitor the condition of the environment, including releases of pollutants and other natural or anthropogenic^{xxxv} materials of a harmful nature.^{xxxvi} These technologies primarily support

“Analytical Services companies which provide environmental sample analysis and other laboratory services such as sampling, monitoring, and lab analysis for environmental samples (soil, water, air, and biological tissue).”^{xxxvii} Similar to pollution control, this sub-set of environmental technology “responds primarily to federal, state and local regulations and programs. These may include the Clean Air Act and its amendments, Clean Water Act, Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act, Toxic Release Inventory reporting requirements and Superfund.”^{xxxviii}

Remediation and Restoration: Remediation is defined as “the cleaning of a damaged or degraded site and restoration of the environment to its former state, so far as is possible, or to remove, contain, or in other ways make safe pollutants, toxic spills, or other contamination.”^{xxxix} In the environmental technology market, “remediation and industrial services are divided into abatement services (in buildings including asbestos, lead paint, radon, etc.), industrial services (for operating facilities such as refineries) and site remediation construction (on contaminated property).”^{xl} In 1992, the EPA developed the Remediation Technologies Development Forum (RTDF), in order to enhance collaboration between the public and private sectors in applying field research and developing innovative technologies and solutions to ongoing and/or pending ecological site remediation issues. “Through the unprecedented collaboration of the RTDF, companies, government agencies, and universities voluntarily share knowledge, experience, equipment, facilities, and even proprietary technology to address mutual remediation problems.”^{xli} Today, the EPA Superfund continues to be a leading driver in domestic remediation and restoration technology.

Developing New Environmental Technology

As noted in the 1998 Department of Commerce report, and briefly discussed above, one of the things government must do is develop policies and programs that stimulate the development of new environmental technologies.^{xlii} Currently, the US EPA runs two programs in this area: “Project XL” and the Environmental Technology Verification (ETV) Program. Project XL (“eXcellence and Leadership”) is a pilot program that allows state and local governments, businesses, and federal facilities to collaborate with the EPA to develop “innovative strategies to test better or more cost-effective ways of achieving environmental and public health protection.”^{xliii} As part of the program, the EPA issues regulatory, policy, or procedural flexibilities that allow the innovation to proceed. The ETV Program is sort of an EPA-run Underwriter’s Laboratory for environmental technology. Through public and private testing partnerships, EPA evaluates the performance of environmental technology with a goal of accelerating the introduction of that technology into the marketplace.^{xliv} While programs of this type provide some assistance, they do not get to the real heart of the problem – the lack of funding for R&D into new technology.

The Canadian Government has adopted a unique approach to this problem that shows some promise – Sustainable Development Technology Canada (SDTC). SDTC is an arm’s length, not for profit corporation created by the government of Canada to finance the development and demonstration of clean technologies – solutions that address issues of climate change, air quality, soil remediation and water quality to deliver environmental, economic, and health benefits to Canada.^{xlv} This initiative facilitates the introduction of innovative technologies into the market, particularly for small to medium sized enterprises, through collaborative

partnerships between academia, corporations, and government. SDTC catalyzes innovation through its financial support in bridging the funding gap often experienced between product demonstration and market development due to the risk aversion of financial institutions. Current projects include: energy exploration/production/transmission/distribution, waste management, transportation, emission controls, and enabling technologies.^{xlvi} SDTC's financial support enables new technologies to bridge the "valley of death" discussed earlier.^{xlvi}

Environmental Technology Industry Assessment

Today, environmental technology is the primary impetus in changing the environmental market place from one driven almost entirely by regulation to one focused on sustainable development^{xlvi} complemented by traditional lines of business. Older methods and processes are giving way to pollution prevention, waste recovery, and re-use. "The international market for environmental technology is being fueled by several important policy and market drivers of demand: greater global focus on sustainable development; liberalization of environmental trade via bilateral and multi-lateral efforts; growing industrialization and environmental awareness in key emerging markets; and broader application of environmental "best practices" by multinationals."^{xlvi} Furthermore, according to EBI, Inc., demand for compliance-oriented consulting is drying up, while demand for strategic environmental management and pollution prevention goes unmet. Clearly, this is a market in transition.

In addition to new technologies, the environmental industry must provide its customers processes that enable those customers (governments and industry) to avoid environmental problems without harming the bottom line. The following section discusses environmental management systems, a systemic approach to achieving these goals.

ENVIRONMENTAL MANAGEMENT SYSTEMS

The EPA defines an EMS as: "... an organizational approach to environmental management . . . [with] [t]he goal of incorporating environmental considerations into day-to-day operations. An EMS provides a structured framework specifically designed to achieve continual environmental improvement."^{li} According to the EPA, a successful EMS should be: "cost effective; economically viable; in harmony with trade regulations; based on systems and performance; practical, usable and useful; and focused on continual improvement."^{li} The five major components of an EMS are: policy; planning; implementation and operation; checking and corrective action; and management review.^{lii}

EMS and the Environmental Marketplace

How does environmental management stack up in terms of the overall environmental industry marketplace? According to *Engineering News Record*, for 2002 the total revenue for US environment-related firms was \$33.0 B.^{liii} The magazine lists work classified as "environmental management" as accounting for \$1.7 B in revenue, or 5.2 % of the total.^{liv} By way of comparison, work classified as "air" accounted for \$1.1 B in revenue (3.3 % of the total) and work classified as "environmental science" for \$1.9 B (5.7 % of the total). The largest

category of work, in terms of revenue generation, was “hazardous waste” which accounted for \$8.9 B in revenue (27 % of the total).^{lv} These figures show that environmental management is a relatively small, yet significant source of revenue for the industry.

The ISO 14001 Standard

ISO 14001 deals with the establishment and operation of an EMS. Published in 1996, ISO 14001 has become the *de facto* standard for EMS worldwide. There are 17 key elements to ISO 14001. We can group these key elements into five principle elements: Environmental Policy; Planning; Implementation and Operation; Checking and Corrective Action; and Management Review.^{lvi} Before getting into details, it is important to note what ISO 14001 is and is not. ISO 14001 is a management “framework for a structured [EMS] that . . . enables an organization to move away from reactive, fragmented responses to environmental issues.”^{lvii} Importantly, however, compliance with an ISO 14001 EMS does not mean that an organization is in compliance with all applicable environmental laws and regulations.

The ISO 14001 model ties all of this together with the concept of a continuous feedback loop. Information garnered throughout the five stages discussed above may be used to change the organization’s goal, objectives, and targets. The goal of the ISO 14001 model is continuous environmental improvement. If an organization’s EMS is functioning in accordance with this model, the organization can obtain registration as compliant with ISO 14001.

Why Use an EMS?

Why should an organization invest the time and money required to implement and maintain an EMS? For the federal government, the answer is easy: because it’s the law. On April 21, 2000, President Clinton issued Executive Order 13148, *Greening the Government Through Leadership in Environmental Management*;^{lviii} this order remains in effect today. Section 201 of the order establishes the goal of Environmental Management: “Through development and implementation of environmental management systems, each agency shall ensure that strategies are established to support environmental leadership programs, policies, and procedures and that agency senior level managers explicitly and actively support these strategies.”^{lix} To achieve this goal, the order requires that “[b]y December 31, 2005, each agency shall implement an environmental management system at all appropriate agency facilities based on facility size, complexity, and the environmental aspects of facility operations.”^{lx}

For private industry, the attraction of EMS is not as obvious. Implementing and maintaining an EMS requires an investment of time, effort (planning, implementation, internal auditing, etc.), and money (consultants, in-house labor, and external certification and audit organizations). Why would a private business choose to make this investment? The following is a brief summary of some of the reasons investment in an EMS makes sense from a business perspective.

Access to markets. In many international transactions, certification of compliance with ISO 14001 is a requirement of doing business.^{lxi} Therefore, US companies who are not certified may find their lack of certification a barrier to market entry overseas. However, most other national or international standards, such as EMAS, now accept ISO 14001 certification as

compliance with their requirements.^{lxii} Therefore, these standards are no longer additional barriers to market entry.

Supply chain requirements. In some industries, organizations at the top of the supply chain are requiring their suppliers to obtain ISO 14001 certification. The best example of this phenomenon is the automobile industry. All of the US automobile manufacturers have required their suppliers to implement an EMS.^{lxiii} For example, General Motors established a date of December 31, 2002 for its suppliers to be ISO 14001 certified.^{lxiv} Obviously, firms in the industry who choose not to obtain certification risk losing their biggest customers – a huge incentive to become certified. Presumably, this is the reason that the automobile industry currently leads the US in the number of organizations certified to ISO 14001.^{lxv}

Decreased regulatory oversight. This is a potentially huge, yet largely unproven to date, benefit of EMS implementation. An example at the federal level is EPA's "Performance Track," discussed earlier. One of the criteria for entrance into Performance Track is adoption and implementation of an EMS.^{lxvi} Because this program is still in its early phases, the exact benefits are yet to be seen. However, the EPA has made it clear that implementing an EMS will not exempt an organization from regulatory requirements. In its May 15, 2002 position statement on EMS, EPA stated: "EMSs do not replace the need for regulatory and enforcement programs, but they can complement them."^{lxvii} To the extent that the EPA and its counterpart state agencies reward EMS implementation, it will provide a huge business incentive to make the EMS investment.

Reduced environmental liability. A properly functioning EMS should greatly decrease an organization's exposure to liability from fines, penalties, and/or civil suits resulting from environmental violations. In addition, adopting an EMS may make it less costly for an organization to obtain insurance, or make it possible to obtain insurance at all.^{lxviii}

Increased efficiency and profits. As with any management system, an EMS provides opportunities for cost savings. Some examples include reduced waste, pollution prevention, and more efficient processes and procedures.^{lxix}

Improved image. Finally, the most commonly cited benefit from adopting an EMS is an improved public image. It is likely that environmentally conscious consumers will reward an organization that is demonstrably trying to reduce its impact on the environment.^{lxx}

While the federal government has mandated the implementation of EMS in Executive Branch agencies, this discussion demonstrates that there is strong business incentive for industry to do the same. These incentives should result in a continuation of the fast growth in ISO 14001 adoption.

CONCLUSION

EBI succinctly summarizes the great challenge facing the environmental industry today: “the environmental economic market [must] internalize the economic externalities of pollution, environmental degradation, and wasted resources into an economic system that values the environment rather than freely permits its exploitation.”^{lxxi} Plainly said, the industry must retain its regulatory baseline, but build a partnership between business, government, and the community to provide an economic competitive advantage so the nation will come to depend upon the efficient allocation and use of resources. Bottom line—the best approach is to shift the focus of creating a demand stemming from regulation toward an economic framework that more closely mirrors a free market.

Globally, governments, industry, and the public must embrace the concept of sustainable development in order for the environmental industry to thrive. More importantly, it is only through this balancing of the needs/capabilities of government, society, and industry that we can protect the environment in which we all live. The decisions the world, especially the developing world, makes in this regard in the near future will determine the state of the environmental industry and, ultimately, the environment itself.

Part II of this paper provides an overview of the state of the environment around the world. It provides the reader more context in which to assess the current state of the environmental industry and the challenges posed to sustainable development.

PART II – GLOBAL OVERVIEW

INTRODUCTION

This part of the paper provides the reader an overview of the state of the environment and the environmental marketplace in four regions of the world: the Americas; Europe; the Middle East; and Africa, Asia, and the Pacific. Our intent is to provide additional context to the first part of the paper so that the reader may better judge the overall health of the environment and the environmental industry. In addition, it should clearly bring into focus the huge differences in the challenges facing the developed and developing worlds in this area.

THE AMERICAS

Overall Condition of the Physical Environment

North America. As the world's largest consumer of natural resources, this region has the highest per capita impact on the global environment.^{lxxii} Legislation that focused more on regulatory pollution abatement than on resource conservation resulted in a steady increase of per capita consumption and waste production over the past 30 years. At the same time, the region managed to post notable progress, especially in air and water quality standards and pollution emissions, from the early 1970s through the late 1990s.^{lxxiii}

Despite these successes, troubling signs remain. While representing only 5% of the earth's population, North America accounts for nearly 26% of global carbon dioxide (CO₂) emissions, more than any other region.^{lxxiv} Energy use grew by 31% in the 30 years since the Stockholm conference.^{lxxv} An increase in the number and size of vehicles, fueled by the region's booming economy, offset advances in fuel efficiency.

The United States is by far the country of greatest concern in this region. Greenhouse gas emissions seem to trend along the same line as economic growth. In economic boom years (e.g. 1984-1988 and 1992-1998), CO₂ emissions increase sharply. During the recession years from 1988 to 1991, CO₂ emissions actually fell slightly.^{lxxvi}

Latin America. The challenges of balancing the demands of the three elements of sustainable development (economic growth, social development, and the environment) continue to plague this region. As such, the region continues to suffer from environmental degradation. A growing population, urban planning shortfalls, income inequality, and the heavy reliance on natural resources to fuel a sputtering economy all contribute to stress on the environment.^{lxxvii}

Despite the challenges faced by this region, there are noteworthy bright spots. Governments have put in place, or are putting in place, policies and institutions to address environmental concerns. Public and private organizations are becoming more engaged in promoting environmental stewardship. Brazil, the country of greatest concern in the region, has put under government protection 10% of the Amazon region, created a national water resources policy and management system, and is promoting renewable energy development (hydro, biomass, and wind power).^{lxxviii} Brazil will no doubt lead the way in attempting to balance the demands of sustainable development in this region.

Environmental Marketplace.

North America. Legislation (regulation) is the primary driver of the environmental marketplace in North America. Regulation, in turn, often is driven by public opinion, perceived or actual, of the condition of the environment. The entire process, then, is bounded by the basic

needs of national security and / or economic pressures.^{lxxix} An environmental disaster (e.g. Exxon Valdez oil spill) or an accidental release of toxic waste can pose threats to national security and drive legislation that impacts the environmental marketplace.

State of the Marketplace. After experiencing four years of growth averaging 4.4 % in the US, the environmental marketplace throughout the region flattened out in 2002 at \$32B (with Canada experiencing limited growth).^{lxxx} Water, environmental management, and environmental science represent the few growth sectors of the market in the US. A combination of decelerated growth, greater competition, price pressures, and consolidation of the market are indicators of a maturing industry and pose barriers to market entry.^{lxxxi} Anticipated Government spending cuts may act to facilitate market entry for niche companies in the environmental management and sciences area (especially as the EPA's budget continues to stagnate and the agency is forced to outsource). With another round of Base Realignment and Closure (BRAC) in sight, the US remediation market may experience an up-tick as contractors begin to prepare government property for development.

Public and NGO Involvement. The influence of public and non-governmental organization environmental movements began to take hold in the early 1970's shortly after the Stockholm conference. International agreement, in the 1980's, on goals for sustainable development provided a wider avenue for grass roots participation in the environmental debate. NGO's and other non-profit public organizations have become influential in setting and maintaining national and regional environmental agendas. One major issue influenced greatly by the public sector is the clean up of the Great Lakes – an issue with broad environmental, economic, and societal (health) impacts in both the US and Canada.^{lxxxii}

Latin America. Unlike the legislative and regulatory drivers in North America, the challenges of competing elements of sustainable development in this region are the driving force behind market activity. The desire for basic human security often outweighs concern about environmental impact. Logging in the Amazon region, for example, is necessary to produce agricultural capability. Limited harvesting by indigenous people has been taking place for hundreds of years. Large scale deforestation by lumber and oil companies provides economic benefit to the government and society and competes with the desire to protect the environment from the impact of those activities.

State of the Marketplace. The environmental market conditions in Latin America are stagnating. From 2001 to 2002, economic and political uncertainty contributed a marketplace decline of 29 % from \$601 M to \$427 M.^{lxxxiii} In an effort to spark and maintain regional government environmental priorities, international contributors provide funding in support of critical issues such as degradation of the Amazon.^{lxxxiv} In turn, these efforts result in environmental market activity. Often, international companies with specific technical expertise partner with smaller, less experienced companies in the region to gain market access.

Public and NGO Involvement. Economics in this region creates a much different environment for public and NGO involvement. Whereas in North America, most people are both physically and economically secure, the same cannot be said of Latin America. In fact, most people struggle to maintain basic human security and subsistence needs. Despite this struggle,

several local and regional groups are organizing to address sustainable development challenges and, in doing so, are beginning to gain credibility with their governments. Ron Mader, an American environmentalist specializing in the NGO's role for sustainable development in Latin American puts it best:

In Latin America, local environmental groups have long received support from multinational environmental groups, such as World Wildlife Fund, Conservation International and the Rainforest Action Network. Now that local groups are receiving more recognition from their own governments, the base of power is shifting.^{lxxxv}

Global Impacts.

North America.

Physical. “North America’s [environmental] global impact is disproportionately large.”^{lxxxvi} The UN GEO-3 reports the primary contributing factor is that the growing economy requires the consumption of additional global resources. While regulatory controls have stemmed green house gas emissions, a booming economy and few conservation initiatives have done little to reduce the region’s global impact. By far the issue most troubling in this region is the disproportionate release of carbon dioxide (CO₂), at five times the world's average, accounting for more than 25% of the world’s total. The region consumes one-third of the world transportation energy and nine times the world average in per capita gasoline.^{lxxxvii}

Marketplace. The region dominates the world environmental market place with \$32.7 B in sales in 2002 as compared with \$2.6 B in sales for the rest of the world.^{lxxxviii} The technology and service sectors account for most of the region’s work.

Latin America.

Physical. The Amazon, by far, has the most global impact in this region. The forest itself covers an area larger than Europe, with the portion in Brazil alone covering an area nearly half the size of the US. This huge forest acts as a sponge, absorbing carbon dioxide – scientists call it a “carbon sink.” World wide, deforestation accounts for more than 25 % of carbon dioxide in the atmosphere. Brazil and Mexico are among the five largest countries releasing carbon into the atmosphere due to deforestation.^{lxxxix} This deforestation reduces the Earth’s ability to reduce the effects of greenhouse gases. An increase in greenhouse gases is known to impact global climate and weather patterns.

Marketplace. At \$427 M in 2002, the region’s environmental market is small in comparison to its neighbor to the North. The nature of the region’s environment creates a market that draws technology and service contractors from more developed countries. These contractors partner with local companies to execute domestic and international grants in support of environmental initiatives.

EUROPE

This section divides the region into four categories: **European Union**; the **United Kingdom**; **Central/Eastern Europe** (Czech Republic, Hungary, Poland, Slovakia, Slovenia, and Hungary) and the **FSU** (the Slavic parts of the former Soviet Union; i.e., Russia and Ukraine).

Overall Condition of the Physical Environment

EU and UK. The countries of the region are developed with sound and effective governments and economic systems. The population is relatively wealthy and well educated. The countries have sufficient natural resources to sustain industry output, but the economies are slowly shifting their focus from industry to services.^{xc} This shift causes lower regional resource consumption, while at the same time shifting the burden of industrial output to Eastern and Central Europe. Another driver for lower environmental stress is the declining population in most Western European countries, with the exception of France and the Netherlands.^{xcj} The region shares many environmental issues, but also shares a significant cultural and political desire to protect and improve the environment. The top environmental issues are air pollution and greenhouse gas emissions, water pollution, soil erosion and over-harvesting of fish stocks.

Eastern/Central Europe and the FSU. These are former Communist countries that have established more or less democratic regimes since the breakup of the Soviet Union in 1991. Some have joined NATO and the EU; others are aspiring nations hoping for future integration in Euro-Atlantic structures. The physical environment in this region is poor. The centralized planning system of the Soviet Union that combined heavy industrialization with agricultural development largely ignored any concerns about depletion of natural resources and environmental protection and/or conservation. Most countries of Eastern, Central Europe, Ukraine and Russia share common environmental problems, among them: water pollution;^{xcii} air quality;^{xciii} solid waste generation;^{xciv} hazardous waste disposal;^{xcv} and nuclear waste and chemical munitions contamination.^{xcvi}

Environmental Market Conditions

UK. The UK environmental market is large and highly competitive, with some 7000 companies, 200,000 employees, and large export sales (over \$3 billion in water and wastewater treatment alone). The future development of the industry will focus on finding renewable sources of energy to replenish fossil fuel depletion. R&D is being done in areas of wind, water, sun, and biomass energy. The Government of the UK is developing a legislative basis to encourage the use of such renewable energy based on targets and incentives.^{xcvii} The sector is expanding greatly, both domestically and internationally, investing in new facilities as well as new services. Strong links with research and educational institutions sustain this expansion.

EU. Many countries that belong to the EU are the world's leaders in production of environmental technologies such as photovoltaics,^{xcviii} wind energy, hydroelectric power, and pollution control through better waste management. There is a strong potential for growth and employment, although this requires a boost in investment directed into R&D. The barriers to the

development and wider use of environmental technologies are economic: high cost on investment due to the perception of risk; complexity associated with transitioning from traditional to environmental technologies; unclear or overly detailed regulations and standards that often are obstacles to innovation; insufficient research efforts; and lack of market demand from public sector and consumers. At present, emphasis is on diversifying environmental instruments and, in particular, on introducing environmental taxes (the "polluter pays" principle), environmental accounting, and voluntary agreements.^{xcix}

Eastern/Central Europe and the FSU. In most of Eastern Europe, especially in Russia, federal and regional authorities have strict environmental legislation in place, but have been reluctant or incapable of enforcing such regulations.^c This lack of enforcement represents a major disincentive for new environmental technologies and equipment. However, the fact that many of the East European countries are aspiring members of the European Community means they must plan to bring their domestic environmental standards up to the norms of the EU. This will necessitate intensified efforts in environmental cleanup, pollution prevention, and sustainment of energy efficiency.

Impact on Global Environmental Marketplace

EU and future opportunities: The candidate countries to the European Union (Bulgaria and Romania) and new members of the EU (Czech Republic, Hungary, Slovenia, Slovakia, and Poland) present tremendous opportunities for environmental industry players over the next decade. These players stand to benefit from these opportunities by investing in R&D and developing products that are suitable for the candidate country markets. EU countries and the UK have an advantage due to their proximity to the region as well as their expertise in providing products specific to the EU environmental directives. However, it is not a foregone conclusion that the EU environmental industry will capitalize on these opportunities, given the stiff competition from their North American counterparts. This presents an opportunity for US industry to provide environmental technologies and services in the key areas of demand: waste management, energy efficiency, and water and wastewater treatment, as well as technologies related to industrial wastewater and hazardous waste.

Studies show that Austria, Germany, France and Denmark play large roles in Central/Eastern European markets, but no single country dominates. Thus the US can use its considerable superiority in environmental technologies to tap the Eastern European market. The main barriers for acquiring environmental technologies by buyer-countries were price and concern about after-sales technical services. Country of origin is not deemed a critical factor – the majority of purchases are made based on technological criteria. Suppliers can expect market success if their products are of high quality and reliability and are accompanied by reliable after-sales services. A permanent presence in the region (an office, representative or strong local partner) greatly enhances the chances of success for foreign suppliers.^{ci}

THE MIDDLE EAST

This section describes the environmental conditions in the Middle East and analyzes the ties between these conditions to various national security issues facing the countries involved. The very close ties between environmental degradation, unsustainable human development and security instability clearly are visible in the Middle East. However, environmental problems are

not the sole cause of instability. Poor governance, of which lack of proper environmental strategy is a part, has a long-term effect on security in the region. Therefore, developing a consistent and long-term environmental strategy is essential in order to decrease security tensions that emerge in the region.

This portion of the paper covers an area ranging from Pakistan, Afghanistan and Iran in the east, the former Soviet Union countries around the Caspian Sea to the north, the Arab Peninsula countries in the south, and the countries along the Mediterranean to the west. It focuses on five key countries that exemplify the overall regional environmental conditions: Afghanistan, Pakistan, Iran, Saudi Arabia, and Israel.

Overall Condition of the Physical Environment

This section will focus on the three major environmental issues in the region: water scarcity and water distribution as a future possible cause for conflicts in the Middle East; environmental degradation in Pakistan and Afghanistan – the impact on society and the enhancement of terrorism; and energy conservation and air and water pollution in Iran and Saudi Arabia.

Water scarcity and water distribution as a future possible cause for conflicts in the Middle East. Global maps of river basins at risk show that there are four currently in dispute.^{cii} These water basins are in severe stress because of the combination of low water availability and high population.^{ciii} Of the three river basins with the most potential for conflict, the Nile River is in Africa, while the other two, the Jordan river and the Tigris-Euphrates rivers are in the Middle East, a region which has the most rapid population growth in the world.

The Jordan River, Israel's primary source of water, lies along the Israeli –Jordanian border and originates in four streams.^{civ} Israel's water availability per capita in 1990 was 470 cu meters; estimates are that it will drop to 310 cu meters by 2025.^{cv} Besides the Jordan River, Israel's groundwater aquifers are responsible for about one fourth of its water resources.^{cvi} However, two of the major aquifers are located in the West Bank and the Gaza Strip. While Israel gradually became an industrialized country over the last three decades, it never took an overarching strategic approach aimed at solving its serious water scarcity problem. Although there are initiatives worth mentioning, such as highly advanced technology for drip irrigation for agriculture, or very efficient systems for reusing water, the overall picture is that Israel is literally "spitting its water away." Over-pumping, water pollution and mismanagement are the main reasons for the continuous degradation of Israel's water resources. Over-pumping created salinization as a result of salt-water intrusion into the aquifers, and is responsible for more than a 20% reduction in the water availability from the coastal aquifer. Water pollution has the biggest effect on Israel's water resources. If the infiltration of untreated sewage continues, it is predicted that it will destroy the aquifer resources. According to "Nationmaster" grading of conditions in the world, Israel has the highest freshwater pollution out of 69 states, is 10th out of 141 in high volumes of water salinization, and is 123rd of 141 in water availability.^{cvi}

Jordan is dependent on the Jordan River as its only source of running surface water. The country's total renewable water resources account for 650 M cubic meters each year but they are currently using 990 M cubic meters per year.^{cvi} Estimates are that due to mismanagement and bad infrastructure, 50% of pumped water is lost because of water theft or leaky pipes.^{cix} Jordan is 2nd out of 69 states in freshwater pollution and 131st of 141 states in water availability.^{cx}

The Tigris and Euphrates Rivers originate in the eastern part of Turkey known as Anatolia. Both rivers pass through Syrian territory to Iraq past Baghdad and the Central Marshes until the point they join around Basra and flow to the Persian Gulf. The Euphrates is Syria's main water source and 85% of Iraq's population is totally dependent on both rivers.^{cxii} Turkey has a growing population and is urbanizing and expanding its industrial base. The country has a new irrigation plan, which involves building 22 dams and irrigation canals along with hydroelectric generating plants that will increase its national income by 12%. This project, however, will cause Syria to lose 40% of its Euphrates water^{cxiii} and Iraq 80% of its water from that river.^{cxiii}

Environmental degradation in Pakistan and Afghanistan – the impact on society and the enhancement of terrorism. Both Pakistan and Afghanistan depend on their natural resources. Both countries face the challenge of a growing imbalance between increasing population and decreasing availability of natural resources to meet the basic needs of their people. For example, Pakistan loses approximately 3-4% of its GDP annually due to environmental degradation.^{cxiv} This fact contributes to the country's all-time high poverty rate of 33%.^{cxv}

Environmental changes in Afghanistan were very gradual until the last two decades. An era of wars and an extreme and isolated regime resulted in a devastated social and environmental situation. The immediate environmental problem is the ill health and premature death caused by biological agents in water, food and soil. Wars have led to water pollution, soil infertility and salination. Deforestation and desertification forced migration, resettlement and spread of environmental diseases. Ten million land mines caused the degradation of farmland and forced millions of farmers and nomads to a sudden change in their lifestyle. Afghanistan, which is an agrarian society, lost 9% of its total usable agriculture land and is currently losing about 3.5% of agriculture products annually since 1978. Afghanistan's regime in the last decade enabled urbanization to spread in the most fertile parts surrounding the major cities, worsening the situation even more. As a result, people started to devastate their close environment resources. The few remaining forests were destroyed, the wood cut and smuggled to Pakistan. The poor farmers sought another cheap and accessible alternative – the cultivation of opium. Afghanistan is currently the major opium producer in the world.^{cxvi}

Air pollution in Iran. Since the Islamic revolution three decades ago, Iran's regime ignored its long-term environmental problems in favor of short-term industrial production and political goals. Years of war with Iraq, international political isolation, and economic sanctions kept its environmental policies a very low priority. Now the country has reached a crisis point as far as its air pollution is concerned. Iran has had a dramatic rise in energy consumption in the last two decades. Overall energy consumption rose from 1.6 quadrillion BTUs in 1980 to 4.7 quadrillion BTUs in 2000, nearly a three-fold increase,^{cxvii} much of it through additional gasoline consumption. Since petroleum products in Iran are subsidized, their cheap cost reduces incentives for more fuel efficiency. As a result, Iran's carbon emissions have risen 240% since 1980.^{cxviii} Teheran alone produces about 1.5 M tons of air pollutant annually. Cars account for 75%-80% of Teheran's air pollution.^{cxix} Moreover, the city's "green lungs," mainly orchards, were destroyed due to urbanization. As a result, Teheran today is one of the most polluted cities in the world.^{cxx} The fact that Iran has 9% of the world's oil reserves and 15% of its natural gas reserves offers the regime no incentive for a fundamental change. However, Iran is trying to diversify its oil-based economy by turning to hydroelectric and nuclear power.^{cxxi}

Saudi Arabia and Persian Gulf pollution. The Persian Gulf is a partially closed sea with average depth of 35 meters. A high rate of evaporation and the extended drilling and oil extraction have all combined to threaten its environment.^{cxxii} As a result, the Gulf water salinity is high; the salinity intensifies towards the northern part of the Gulf.^{cxxiii} About 40% of the world's total oil transportation passes through the Gulf. Estimates are that about 8 M metric tons of oil sludge is released to the Gulf annually. A combination of water pollution and high salination has dramatic long-term consequences to the countries in the region, especially to the Kingdom of Saudi Arabia. Saudi Arabia depends on water from the Persian Gulf and desalination processes for its water for sanitary and irrigation purposes.^{cxxiv} Predictions are that the continuation of Gulf water pollution will lead to a crisis for the local populations along the Gulf shorelines as well as for the Gulf countries' water desalinating projects.^{cxxv}

The Environmental Market – Regional and Global Initiatives

As a rule, the Middle East countries lack the political will to implement any long-term environmental strategy. In addition, with an absence of a regulatory trigger and the lack of funds to finance environmental projects, countries have no ability to develop viable governmental or private environmental sectors. Therefore, environmental programs are initiated either on a regional basis and/or involve a third party and are based on a clear definition of mutual interest (which is usually mutual economical benefit or a platform to an agreement over political disputes).

In fact, the international community through UN institutions funds the majority of the projects. UNEP (United Nation Environmental Program) declared the Persian Gulf, along with other sensitive marine ecosystems, a special area. As a result, eight Persian Gulf states signed a protocol aimed to protect the Gulf from further contamination.^{cxxvi} In Iran, UNDP (United Nation Development Program) launched initiatives funded by two trust funds: the Global Environment Facility (GEF), and the Montreal Protocol on Substances that Deplete the Ozone Layer (MP). The MP aims to help Iran to comply with its global commitment concerning air pollution and the ozone depletion problem.^{cxxvii}

Pakistan is one of the only states in the region to launch a National Conservation Strategy (NCS) as an environmental policy at the sectorial level. The post-NCS period shows a significant progress towards the creation of institutions and policies for the environment sector. The Pakistan Environmental Protection Act of 1997 established provincial Environmental Protection Agencies and approved National Environmental Quality Standards (NEQ). Even so, most of the country's programs are in close cooperation with UNDP, which mobilized multilateral funds of the Montreal Protocol and GEF together with NGOs to help the Pakistani government plan.^{cxxviii}

As far as the environmental water issue is concerned, two types of initiatives deserve mention. The first is regional or bilateral agreement in order to solve regional water disputes through cooperation. The second is government's initiatives to solve their own water pollution problems recognizing the need to move from distribution policy to conservation policy in anticipation of upcoming water crises. These initiatives promise some business opportunities for the environmental industry, assuming that the governments involved can secure funding.

AFRICA, ASIA, AND THE PACIFIC

This section provides a general overview of the environmental issues in Africa, China, East Asia, and some portions of the Pacific. It also looks at the potential of environmental markets in these regions.

Africa

Climate Change, Water, Air, Population, and Natural Resources. Africa's people and economies are heavily dependent on rain-fed agriculture. According to UNEP records, Africa's annual rainfall has been decreasing since 1968, possibly due to global warming emissions.^{cxxxix} There also is evidence that natural disasters, particularly drought, in the Sahel region have become more common and more severe. Numerous countries in the region routinely suffer through drought.^{cxxx} Droughts and floods create increasing pressure on fragile lands and result in the displacement of wildlife and people as well as adding to increased soil erosion and silting up of rivers, dams, and the coastal waters.

Deforestation and devegetation, particularly in the East, Central and southern Africa regions has resulted in encroachment of the Sahara and Namib deserts. Over harvesting of wood for the construction industry and overgrazing of livestock have led to deforestation and soil erosion on a large scale. In addition to environmental issues such as deforestation, falling water tables, and exposure to air and water pollution, Africa appears especially vulnerable to global environmental problems such as deforestation and climate change.^{cxxxi}

Air pollution. Emissions of carbon dioxide, the main global warming gas, have risen to 8 metric tons of carbon per year. However, these figures are far much less than those of developed countries like Japan and Germany.^{cxxxii} The continent is still vulnerable to the impacts of greenhouse gases as development and industrialization takes place. South Africa accounts for 42% of all of Africa's CO₂ emissions.^{cxxxiii}

Northern Africa States. Most of Northern Africa is desert, spanning from Senegal, Mali, eastwards through Morocco to Libya, Algeria, Tunisia and Egypt. The biggest environmental concerns in this region are population growth, food security, water availability and resources.

As in the Middle East, the prospect of conflict over the availability of fresh water exists in Africa. As an example, in 1996 Egypt announced plans for a \$223 M canal designed to bring water to the country's arid western desert. This new project, which diverts water from the Nile, may hold the key to Egypt's prospects for feeding its growing population. However, this project is taking place at a time when the East African nations of Kenya, Tanzania, Rwanda, and Uganda are all up in arms against a colonial treaty drawn in 1929 by the British colonial government. According to the treaty, these East African nations are not allowed to use the water from Lake Victoria, the largest lake in Africa and a source of the Nile, for irrigation or any other agricultural activities. These nations have called for fresh talks on this issue, while Tanzania refused to recognize the treaty at independence and uses Lake Victoria water for all her needs.^{cxxxiv}

Sub-Saharan Africa and the Pacific. The single largest environmental problem facing Sub-Saharan Africa is access to fresh water. This region continues to rely on rainwater for

livestock farming and food production. Because of a lack of resources and planning, the region lags far behind the rest of the world in harvesting rainwater for irrigation for farming. In 1999, for example, 42% of arable land in Asia was under irrigation. In North Africa, the figure was 31%, but in Sub-Saharan Africa, only 4% of arable land is under irrigation. Irrigation increases yields of most crops by 100 to 400%. FAO estimates that over the next thirty years, 70% of grain production is expected to come from irrigated land. By way of further comparison, in Pakistan, 80% of food is produced on irrigated land. In China 70%; India and Indonesia more than 50%, while in Ghana in West Africa, and Malawi and Mozambique in East /Southern Africa the amount is only 2%.^{cxxxv}

Africa and Pacific markets potential. Africa's market potential is between \$5-8B for the years 2005 to 2010. East Asia and the Pacific will have a \$35 to \$46B potential during the same period.^{cxxxvi}

India.

India's greatest environmental problem is the pressure on land and resources due to the huge population. Nowhere are the pressures of population and related environmental stresses more evident than in India. India's rapid population growth has created serious and potentially destabilizing demographic and environmental stress. India stands out as a veritable model of the interplay of economic and ecological pressures. These strains, of course, are not new. A generation ago, the second Indian study sponsored by the Ford Foundation predicted crisis in the provision of water, sanitation and other basic environmental services due to India's growing urban population. Although disaster has been largely averted, these demands remain pressing.^{cxxxvii}

In many parts of India, the number of people living below the poverty line has decreased over the last several decades.^{cxxxviii} The amount of land per person has fallen steadily, however, India's green revolution has increased agricultural yields per acre and has therefore achieved somewhat of an improved picture with regard to food supply. Thus, although the population growth rate in the 1990s was 2.1 %, down only a bit from the 2.2 % levels of 1970, resource and environmental crises have not led to massive political instability.^{cxxxix}

In important respects, however, India's environment has deteriorated and resource strains remain a potential tinderbox for political instability. Much of India's irrigation system is silting up because of deforestation in upland areas. Millions of acres of farmland have become flooded or salinized because of improper irrigation practices; water tables in many parts of the country are falling. Along the coast, salt water is penetrating aquifers, increasing the number of Indians who do not have adequate fresh water supplies.^{cxl}

Deforestation and devegetation, estimated at 330,000 hectares per year, undermine the quality of life in many parts of rural India. Over harvesting of wood for fuel and overgrazing of livestock have led to soil erosion on a massive scale. Land conversion threatens not only subsistence agriculture but also India's once abundant biodiversity. Deforestation in the Himalayas has resulted in downriver silting and rising riverbed levels. This in turn has created a flashpoint for unrest that might have an impact on regional security.^{cxli}

In addition to environmental issues such as deforestation, falling water tables, and exposure to air and water pollution, India appears especially vulnerable to global environmental problems such as climate change.^{cxlii} A small rise in sea levels would affect millions of Indians

and Bangladeshis, possibly creating a refugee crisis in India. In fact, it is estimated that nearly 20,000,000 Bengali refugees and migrants already live in India, having fled their native land because of floods and the food crisis. Climate change could increase the weight of India's burden.^{cxliii}

India's environmental market potential. India's environmental market had a potential of \$4.5B in the next five years and \$7B by the year 2010, according to the Confederation of Indian Industry.^{cxliv} India's commitment to clean up the environment and force industries to convert to cleaner and more effective technologies is also encouraging to environmentalists. European sources for environmental projects in Asia, and prominent agencies providing financial assistance in India, are the European Community Investment Partners scheme for promoting private sector participation in individual companies, ASIA-INVEST, ASIA-URBS and ASIA-EcoBEST. They have all been assisting India in the process of identifying an Asian partner for technology transfer.^{cxlv}

The German Agency for Technical Cooperation has pledged to make available a sum of approximately Euros 100M in the next two years exclusively for promoting cooperation in the sector. Germany's Bank of Reconstruction is providing long-term funding for expansion of infrastructure and environment protection. With institutional funding available, small and medium enterprises in Europe are now looking at Asia's developing countries that are taking a more focused look at the environment sector and adopting urgent measures to create economic growth compatible with sound environmental policy.^{cxlvi}

China

Overall environmental conditions. China has emerging major world environmental concerns. Today, China is the world's 2nd highest consumer of energy after the US. China also emits more greenhouse gases than any country except the US. If China continues to maintain her current economic growth of 5-7 % per year, its economy will increase three to five-fold by 2025. This will create enormous consequences for the rest of the world in energy consumption, air pollution, and resource deprivation. Chinese experts predict that China's resources will fall short by approximately 8% in 2010 and by 24 % in 2040.^{cxlvii}

The Environmental Situation in China . During the past 20 years, China has been moving from a rural agriculture-based society to an urban-industrial society and from a command economy to a market economy. This has resulted in some 400 million people moving from rural to urban areas. The figure is projected to double to 800 million by 2020. As a result, China's economy has grown on an average of 10% per year over the last 20 years. The economic growth and the rural-to-urban migration have powered considerable rises in energy consumption. In 1997, China accounted for 10% of the global energy consumption, second to the US. By 2020, China will be consuming 14 to 16 % of the total world energy. In addition, pressure is growing on natural resources. China has 22% of the world's population living on 7% of the world's arable land. Per capita farmland, grassland and water resources are less than 1/3 the world's average.^{cxlviii} Large amounts of land are lost each year to desertification caused by soil erosion from deforestation and over grazing.^{cxlix}

Energy. 70% of China's energy is produced from coal. Chinese authorities are currently engaged in a major debate over how to diversify supply without harming the country's security or further damaging the environment.^{cl}

Chinese government current plans and environmental market potential for the future. China's current five-year plan (2001 to 2005) estimates environmental objectives will require investments totaling to around \$85 B. Major priority areas are: construction of sewage treatment plants for the urban areas; control of industrial liquid waste; air pollution control, including equipment; and construction of solid and hazards waste disposal facilities.^{cli}

CONCLUSION

As noted in the introduction, this section brings into focus the huge differences between the developed and developing worlds with respect to environmental problems. The developed world has the luxury of focusing on ways to protect and enhance the environment in order to improve an already high standard of living. It also has the ability to develop and sustain an environmental industry. In stark contrast, the developing world must struggle to balance some protection of the environment against the need to provide its people with the most basic standard of living. Without the help of the developed world (through bilateral and multilateral means), there is little business opportunity for an environmental industry. If the global environmental industry, and the global environment, is to flourish, the world must find a way to achieve the lofty goals of sustainable development.

APPENDIX 1 – ENVIRONMENTAL INDUSTRY SEGMENTS

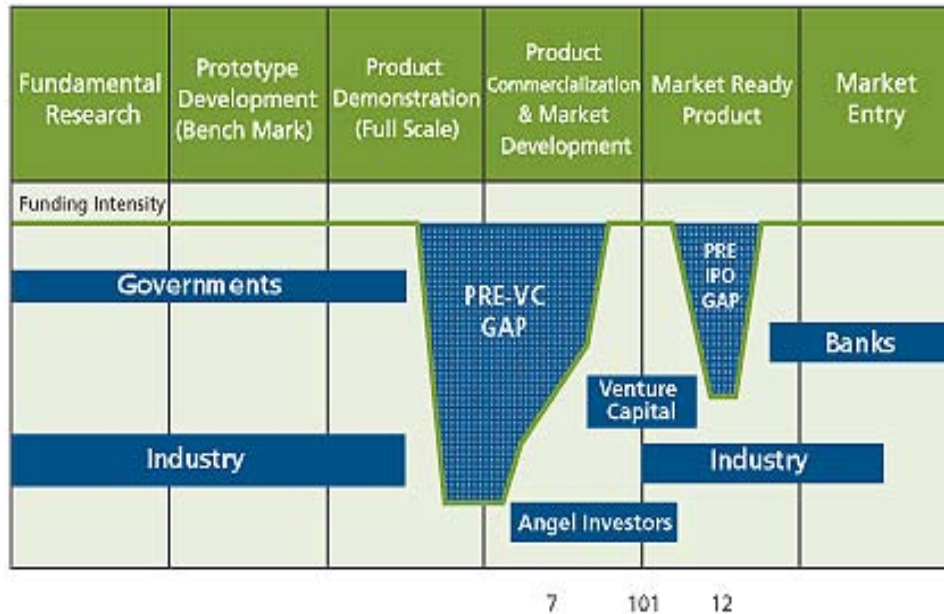
Segment	Description	Examples of Clients
Environmental Services		
Environmental Testing & Analytical Services	Provide testing of "environmental samples" (soil, water, air and some biological tissues)	Regulated industries, Government, Environmental consultants Hazardous waste and remediation contractors
Wastewater Treatment Works	Collection and treatment of residential, commercial and industrial wastewaters. Facilities are commonly known as POTWs or publicly owned treatment works.	Municipalities, Commercial Establishments & All industries
Solid Waste Management	Collection, processing and disposal of solid waste	Municipalities & All industries
Hazardous Waste Management	Manage on-going hazardous waste streams, medical waste, nuclear waste handling	Chemical companies, Petroleum companies, Government agencies
Remediation/Industrial Services	Physical cleanup of contaminated sites, buildings and cleaning up of soil, groundwater or operating facilities	Government agencies, Property owners, Industry
Environmental Consulting & Engineering (C&E)	Engineering, consulting, design, assessment, permitting, project management, O&M, monitoring, etc.	Industry, Government Municipalities, Waste Mgmt. companies, POTWs
Environmental Equipment		
Water Equipment & Chemicals	Provide equipment, supplies and maintenance in the delivery and treatment of water and wastewater.	Municipalities & All industries
Instruments & Information Systems	Produce instrumentation for the analysis of environmental samples. Includes info systems and software.	Analytical services, Government, regulated companies
Air Pollution Control Equipment	Produce equipment and tech. to control air pollution. Includes vehicle controls.	Utilities, Waste-to-energy Industries, Auto industry
Waste Management Equipment	Equipment for handling, storing or transporting solid, liquid or haz. waste. Includes recycling and remediation equipment.	Municipalities, Generating industries, Solid waste companies

Process & Prevention Technology	Equipment and technology for in-process (rather than end-of-pipe) pollution prevention and waste treatment and recovery	All industries
Environmental Resources		
Water Utilities	Selling water to end users	Consumers, Municipalities & All industries
Resource Recovery	Selling materials recovered and converted from industrial by-products or post-consumer waste	Municipalities, Generating industries, Solid waste companies
Environmental Energy Sources	Selling power and systems in solar, wind, geothermal, small scale hydro, energy efficiency and DSM	Utilities, All industries and consumers

Source: [Environmental Business International Inc.](#) (San Diego, Calif. USA)

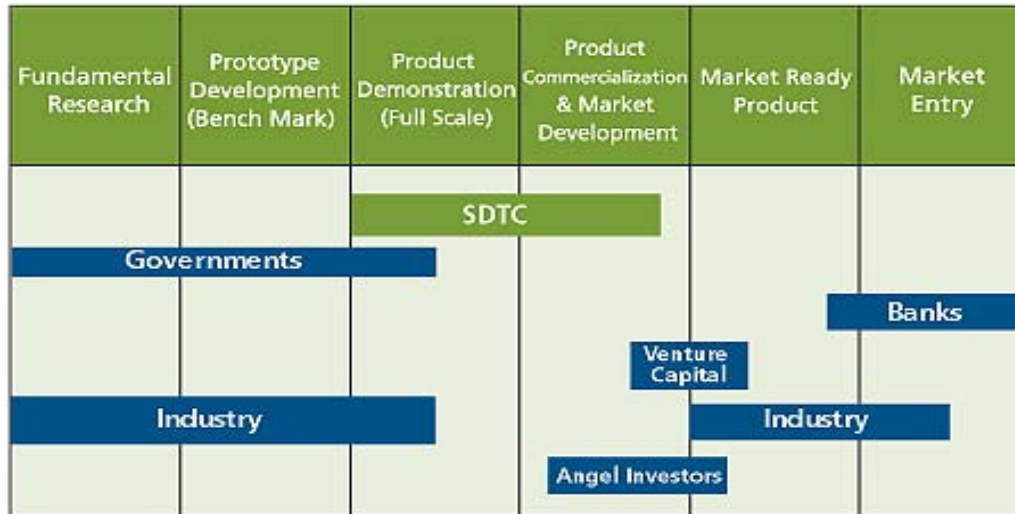
APPENDIX 2 – FUNDING ENVIRONMENTAL TECHNOLOGY

The first chart graphically depicts the “valley of death” – the stage in the development of technology where lack of financing often kills a good idea. The second chart displays how programs such as the Canadian Government’s Sustainable Development Technology Canada program can help bridge this valley.



of Energy and Environment Deals by Stage*

* Source: Macdonald & Associates, Oct 2002



ⁱ United Nations, UN Department of Economic and Social Affairs, Division for Sustainable Development, Online at <http://www.un.org/esa/sustdev/index.html>.

ⁱⁱ OECD Policy Report, “The Global Environmental Goods and Services Industry”, 1996, p. 4. Online at <http://www.oecd.org>.

ⁱⁱⁱ David R. Berg and Grant Ferrier, *Meeting the Challenge: US Industry Faces the 21st Century, The US Environmental Industry*, US Department of Commerce, Office of Technology Policy, September 1998. Online at <http://www.technology.gov/Reports/Environmental/env.pdf>.

^{iv} OECD Policy Report, “The Global Environmental Goods and Services Industry”, 1996, p. 4.

^v Environmental Business International, Inc., *The US Environmental Industry Overview*, Summer 2002.

^{vi} David R. Berg and Grant Ferrier, *Meeting the Challenge: US Industry Faces the 21st Century, The US Environmental Industry*, US Department of Commerce, Office of Technology Policy, September 1998, p. 10. Online at <http://www.technology.gov/Reports/Environmental/env.pdf>.

^{vii} *Ibid*, p.18.

^{viii} *Ibid*, p. 20.

^{ix} Class notes from lecture by Mrs. E. Zeytoun, U.S Department of Commerce.

^x It wasn’t until the mid-1960s that people really became concerned about environmental quality and the impact of environmental degradation on human health. It began with Rachel Carson’s book, *Silent Spring*, which discussed the impact of chemicals on animals and how that could lead to harm in humans. [Rachel Carson, *Silent Spring*, Mariner Books, 1962.] Additionally, several high profile environmental disasters occurred in the late 1960s, including the blowout of Union Oil’s Platform A in the Santa Barbara channel. Fires erupted multiple times throughout the century on the Cuyahoga River in Ohio, prompting a June 22, 1969 issue of *Time* to describe the Cuyahoga “as the river that ‘oozes rather than flows’ and in which a person ‘does not drown but decays.’” [Cuyahoga River Area of Concern, US Environmental Protection Agency website, online at <http://www.epa.gov/glnpo/aoc/cuyahoga.html>.] These disasters galvanized the public and led to the first Earth Day on April 22, 1970. Pressure began to mount on government at all levels to take a more active role in protecting the environment and diminishing the associated human health impacts.

^{xi} *The Guardian: Origins of the EPA*, US Environmental Protection Agency, online at www.epa.gov/cgi-bin/epaprintonly.cgi.

^{xii} *Ibid*.

^{xiii} Environment Council of the States website, online at <http://www.sso.org/ecos/states/Stateinfo.htm> “In order for delegation to occur, the state legislature must have passed authorizing legislation that is at least as stringent as the federal standard while demonstrating the State has adequate resources to run the program. The State then files a petition with the EPA.” *Ibid*.

^{xiv} *Ibid*.

^{xv} Essentially, overfiling means the EPA will conduct enforcement action, even after the State has already initiated enforcement.

^{xvi} “Report to Congress: State Environmental Agency Contributions to Enforcement and Compliance,” The Environmental Council of the States, April 2001, p.13, online at <http://www.sso.org/ecos/publications.htm>.

^{xvii} *Ibid*, p.21.

^{xviii} *Reilly and the New Environmentalism*, Occupational Hazards, Jun 1992, Vol 53, Issue 6, p. 35.

^{xix} David Helvarg, *Unwise Use: Gail Norton’s New Environmentalism*, The Progressive, June 2003, p. 27.

^{xx} Lynn Scarlett, *The Libertarian at Interior*, The Washington Post, November 6, 2001, A21.

^{xxi} *National Environmental Performance Track Program Guide*, US Environmental Protection Agency, online at <http://www.epa.gov>.

^{xxii} To qualify for the program, companies must achieve the following: adopt and implement EMS; demonstrate specific environmental achievements and commit to continued environmental improvement; commit to public outreach and performance reporting; and have a record of sustained compliance with environmental requirements. *Ibid*, p. 3.

^{xxiii} David R. Berg and Grant Ferrier, *Meeting the Challenge: US Industry Faces the 21st Century*, *The US Environmental Industry*, US Department of Commerce, Office of Technology Policy, September 1998, at 33. Online at <http://www.technology.gov/Reports/Environmental/env.pdf>.

^{xxiv} *Ibid*, p. 29.

^{xxv} Environmental Business Journal, *Industry Overview*, Aug. 2003, online at <http://environmental-industry.com/ebj/inov20volno5.html>.

^{xxvi} See the discussion regarding Sustainable Development Technology Canada (SDTC) in the “Environmental Technology” section, below, for an approach to overcoming this problem of a lack of capital.

^{xxvii} *Ibid*, p.3.

^{xxviii} US Department of Commerce, *Environmental Technologies Industry FY2004 Industry Assessment*, p. 6.

^{xxix} *Ibid*, p.7.

^{xxx} The Council of the Global Environment Facility (GEF) is an international financial organization comprising 176 nations that acts as a catalyst to improve the global environment. Their grants support projects in developing countries and countries with economies in transition to protect the global environment while helping to create livelihoods among the world's poorest people. Since its creation in 1991, the GEF has allocated \$4.5B in grants to over 140 developing nations in support of more than 1300 projects. These grants promote the development of markets for items such as fuel cells, provide assistance to environmentally friendly small and medium-sized businesses, and assist nations in protecting their environments. Global Environment Facility Website, online at http://www.gefweb.org/what_is_the_GEF.html.

^{xxxi} US counties are partnering with state and federal governments, lenders, and insurance brokers to issue loans to make up for the lack of financing to redevelop brown fields. For instance, Nassau County recently partnered with New York City in creating a multi-million dollar fund to finance redevelopment of contaminated properties in the metropolitan region. Local legislation provides tax incentives for developers and shields lenders, municipalities and other third parties from future liability at the sites. [Rosmaria Mancini, *Nassau and Yonkers Counties Join NYC in Creating Multi-Million Dollar Brownfield Fund*, Long Island Business News, December 19, 2003.] Wisconsin is introducing legislation to create an environmental trust financing program to provide companies with low interest loans to pay for environmental upgrades and repairs. The law will allow the company to charge customers to pay the interest on the loans which is lower than if the company passed on their total costs for the upgrades. For example, a utility company would borrow \$1B and the interest to pay off the loan plus funds to generate a rate of return or profit. In this case, the bill is \$150 – 170M yearly in extra costs borne by customers. Under the environmental trust fund, the utility company would earn no rate of return and annual costs to pay off the loan would be limited to \$70M yearly in interests. The utility company benefits by not having to borrow as much money in traditional financing mechanisms. The customer benefits by having the company make improvements and not having to pay for its return or profit. [Thomas Content, *Customers May Pay Price for Utility's Violations: Wisconsin Energy Proposes Trust to Finance Environmental Upgrades*, Milwaukee Journal Sentinel, January 14, 2004.] States can also provide financing through initiatives that implement tax-incremental financing. These programs set aside tax revenues on projects to help fund costs associated with their development. A housing developer in St Louis, Missouri is using this incentive to build a 500-acre "green community." The market is wide open since home owners now demand more of park setting with natural open spaces, parks, lakes, and environmentally friendly recreation.

^{xxxii} Congress is considering legislation that provides for \$2B in "green bonds" which offer tax-exempt financing as an incentive to encourage developers to use energy-efficient technology and building materials. Some states already have Green Investment Funds to help pay for emerging green building practices and technology. In Portland, Oregon, such a fund allows the city to

identify good building practices and share that information for use in other projects. So far, the Portland Fund provided “green grants” for 37 commercial building projects totaling more than 1.5M square feet of office space. [Stephanie Basalyga, *Portland Office of Sustainable Development Offers Grants for Environmentally Designed Projects*, Daily Journal of Commerce, December 22, 2003.] Additionally, the US Green Building Council sponsored an international conference to advance “green” design, construction, project financing, and building management. This presents a new market for U. S. builders in the international market and an opportunity to establish the US construction industry as a world leader in the environmental industry.

^{xxxiii} National Science and Technology Council, *Bridge to a Sustainable Future: National Environmental Technology Strategy*, US Government Printing Office, Washington, D.C., April 1995, p. 3.

^{xxxiv} United Nations Environmental Program, *Environment Management Tools*, online at <http://www.uneptie.org/pc/pc/tools/ast.htm>.

^{xxxv} Anthropogenic materials refer to those which cause environmental changes such as habitat change or pollution.

^{xxxvi} Science and Technology Institute, *Environmental Technology Definitions*, online at: <http://www.rand.org/scitech/STPI/Environ/envtech.html>.

^{xxxvii} Environmental Business International, Inc., *EBI Report 2000B: The US Environmental Industry Overview*, Summer 2002, p.22.

^{xxxviii} *Ibid*, p.22

^{xxxix} Jill Bailey, *The Facts on File Dictionary of Ecology and the Environment*, Market House Books, 2004, p.204.

^{xl} Environmental Business International, Inc., *EBI Report 2000B: The US Environmental Industry Overview*, Summer 2002, p.36.

^{xli} RTDF website, online at <http://www.rtdf.org/public/general.htm>

^{xlii} David R. Berg and Grant Ferrier, *Meeting the Challenge: US Industry Faces the 21st Century, The US Environmental Industry*, US Department of Commerce, Office of Technology Policy, September 1998, p. 33. Online at <http://www.technology.gov/Reports/Environmental/env.pdf>.

^{xliii} US EPA, Project XL website, online at <http://www.epa.gov/projectxl/file2.htm>.

^{xliv} US EPA, ETV website, online at <http://www.epa.gov/etv/>.

^{xliv} SDTC website, online at <http://www.sdtc.ca/en/>.

^{xlvi} *Ibid*.

^{xlvii} See the discussion in the “Economics of the Environment” section above and the chart at Appendix 2.

^{xlviii} Sustainable development describes efforts to guide economic growth, especially in less developed countries, in an environmentally sound manner, with emphasis on natural resource conservation.

^{xlix} US Department of Commerce, *Environmental Technologies Industry FY2004 Industry Assessment*, p. 4.

¹ US EPA, *Overview of Environmental Management Systems (EMS)*. Online at <http://www.epa.gov/ems/info/overview.pdf>.

^{li} *Ibid.*

^{lii} *Ibid.*

^{liii} Andrew G. Wright, et. al., *The Top 200 Environmental Firms*, Engineering News Record, June 2, 2003, p. 59.

^{liv} *Ibid.*

^{lv} *Ibid.*

^{lvi} Defense Environmental Network and Information Exchange, *ISO 14001—Essential Elements*, online at <http://www.denix.osd.mil/denix/Public/Library/EMS/Documents/elements.html>.

^{lvii} Defense Environmental Network and Information Exchange, *Introduction to the ISO 14000 Series*, online at <http://www.denix.osd.mil/denix/Public/Library/EMS/Documents/elements.html>.

^{lviii} Executive Order 13148, April 21, 2000, online at <http://ceq.eh.doe.gov/nepa/regs/eos/eo13148.html>. Executive Orders have the force and effect of law for executive branch agencies.

^{lix} *Ibid.*, section 201.

^{lx} *Ibid.*, section 401b.

^{lxi} Sally L. Goodman & Det Norske Veritas, *Is ISO 14001 an Important Element in Business Survival?*, online at http://www.iso14000.com/Implementation/dnv_article.htm.

^{lxii} See, Quality Network, online at <http://www.quality.co.uk/bs7750.htm> and Department for Environment, Food, and Rural Affairs, United Kingdom, *An Introductory Guide to EMAS*, online at <http://www.emas.org.uk/guidance/EMAS/Introductory/Guide.pdf>, with respect to British Standard 7750 and EMAS.

^{lxiii} Russell V. Thornton, *ISO 14001 Certification Mandate Reaches the Automobile Industry*, online at <http://www.iso14000.com/WhatsNew/News05.htm>.

lxiv *Ibid.*

lxv *Ibid.*

lxvi *Ibid* at <http://www.epa.gov/performancetrack/program/ems.htm>.

lxvii *United States Environmental Protection Agency Position Statement on Environmental Management Systems (EMSs)*, May 15, 2002, online at <http://www.denix.osd.mil/denix/Public/Library/EMS/Documents/epa-ems-position.pdf>.

lxviii Sally L. Goodman & Det Norske Veritas, *Is ISO 14001 an Important Element in Business Survival?*, online at http://www.iso14000.com/Implementation/dnv_article.htm.

lxix *Ibid.*

lxx *Ibid.*

lxxi Environmental Business International, Inc., *The US Environmental Industry Overview*, Summer 2002.

lxxii United Nations Environmental Program, *Global Environmental Outlook – 3, Synthesis*, online at <http://www.unep.org/GEO/geo3/english/overview/001.htm>. [Hereinafter “GEO-3.”]

lxxiii Examples of this progress include: Reduced CFC use to nearly zero by 1996; Reduced acid rain emissions by 31% in the US; Upward of 13% of the region’s land area is set aside and protected including more than 2M acres of wetlands in Canada; Reduced point source emissions by 29% in the US; Reduced release into the Great Lakes by 71%; and Stabilized desertification resulting in reduced wind and water erosion. Data for North, Central, and Latin America extracted from GEO-3.

lxxiv GEO-3.

lxxv *Ibid.*

lxxvi *Ibid.*

lxxvii *Ibid.* The following examples highlight the magnitude of this challenge: A full 25% of the world’s forest cover the region. Over the past 30 years, more than 395 million acres of forest were depleted (representing nearly 19% of the region’s remaining forests and 40% of the loss worldwide during the same period); Nearly 750 million acres of arable land were degraded; Nearly 50% of the region’s land mass is impacted by development and poor environmental policy enforcement; Air and water pollution, especially in burgeoning urban areas is widespread affecting nearly 75% of the population (urban population grew from 176 million to 390 million in 30 years); and More than 30% of the reefs in the Caribbean are at risk.

^{lxxviii} Seth Dunn, *Reading the Weathervane (Climate Policy from Rio to Johannesburg)*, World Watch Paper 160, August 2002, online at <http://www.worldwatch.org/pubs/paper/>.

^{lxxix} ICAF Environmental Industry Study Notes 5 Mar 2004. Guest speaker: Bob Bax, Parsons Infrastructure and Technology Group, Inc.

^{lxxx} ICAF Environmental Industry Study Notes 5 Mar 2004. Guest speaker: Dr. Vincent Ciccone RASco, Inc.

^{lxxxi} Vincent Ciccone, Dr. “Numerous and Diverse Market Sectors”, (slide number 3), ICAF presentation 5 Mar 2004.

^{lxxxii} GEO-3, p. 193

^{lxxxiii} Vincent Ciccone, Dr., “Market Breakdown”, (slide #5), ICAF presentation 5 Mar 2004
OK?

^{lxxxiv} Franklin C. Moore, Office of Environmental Science and Policy, US Agency for International Development, 4 Mar 2004, ICAF Environment Industry Study presentation.

^{lxxxv} Ron Mader, *Environmental NGO's in Latin America*,
<http://www.planeta.com/ecotravel/mexico/96ngos.html>

^{lxxxvi} GEO-3, p. xv.

^{lxxxvii} GEO-3, p. xv.

^{lxxxviii} Vince Ciccone, slides 4 and 5.

^{lxxxix} Rainforest Action Network, *Rainforests and Global Warming Fact Sheet*, online at http://www.ran.org/info_center/factsheets/04a.html.

^{xc} United Nations Economic Commission for Europe, *Europe's Environment: the Third Assessment*, online at http://reports.eeq.ev.int/environmental_assessment_report_2003_10_sum/en/kiev.

^{xci} *Ibid.*

^{xcii} Much of the population of the poorer Eastern European nations and less than half the population of Russia have access to safe drinking water. While water pollution from industrial sources has diminished because of the decline in manufacturing, municipal wastes increasingly threaten key water supply sources, and nuclear contamination could flow into water sources.

^{xciii} The number of vehicles on the roads has increased rapidly; their emissions will offset reductions in industrial air pollution due to reduced economic activity and greater reliance on natural gas.

^{xciv} Has increased substantially due to adoption of Western-style consumption patterns. Many local governments lack management expertise and landfill capacity to cope with this problem.

^{xcv} The problems are extensive and growing. In Russia alone, it is estimated that about 200 metric tons of the most highly toxic and hazardous wastes are dumped illegally each year in locations that lack effective environmental or public health protections or oversight.

^{xcvi} It is so costly to reverse that remediation efforts are likely to continue to be limited to simply restricting access to contaminated areas.

^{xcvii} UK Trade and Investment website, online at <http://www.tradepartners.gov.uk/environment/profile>.

^{xcviii} Systems which use semiconductor materials to convert sunlight directly to electricity.

^{xcix} European Union website, online at <http://www.europa.eu.int/comm/environment>.

^c Smithsonian Institute, Woodrow Wilson Center, online at <http://www.wilsoncenter.org>.

^{ci} Regional Environmental Center for Central and Eastern Europe website, online at www.rec.org.

^{cii} Erwin E. Klaas, *Potential for Water Wars in the 21st Century*, online at <http://www.public.iastate.edu/~mariposa/waterwars.htm>.

^{ciii} On average, these water basins can supply less than 500 cu meters of water per person per year (1000 cu meters per person per year is a minimum water requirement for an efficient moderately industrialized nation). By comparison, while the average of available fresh water in Asia and the Middle East is 392 cu meters per person per year, in North and Central America the average is 1,740 cu meter per person per year. *Ibid*.

^{civ} The first is in Syria and runs through Lebanon to Israel, the second is in the Golan Heights, the third in the West Bank, and the fourth in Syria and runs along the Syrian – Jordanian – Israeli borders into the Jordan River. *Ibid*.

^{cv} Erwin E. Klaas, *Potential for Water Wars in the 21st Century*, online at <http://www.public.iastate.edu/~mariposa/waterwars.htm>; Columbia University Library Online, *Water in the Middle East*, online at <http://www.columbia.edu/cu/lweb/indiv/mideast/cuvlm/water.html>.

^{cvi} *Ibid*.

^{cvii} Nationmaster.com website, online at http://www.nationmaster.com/graph-T/env_wat_sus_sol/MID.

^{cvi} Erwin E. Klaas, *Potential for Water Wars in the 21st Century*, online at <http://www.public.iastate.edu/~mariposa/waterwars.htm>; Columbia University Library Online,

Water in the Middle East, online at
<http://www.columbia.edu/cu/lweb/indiv/mideast/cuvlm/water.html>.

^{cix} For example, during a 1998 drought the water black market prices were \$30 per 5,000 liters (average per capita annual income is \$1,100). While public water taps for citizens were open twice a week, the private swimming pools of the “haves” were very much alive. *Ibid.*

^{cx} Nationmaster.com website, online at http://www.nationmaster.com/graph-T/env_wat_sus_sol/MID.

^{cx} Erwin E. Klaas, *Potential for Water Wars in the 21st Century*, online at <http://www.public.iastate.edu/~mariposa/waterwars.htm>; Columbia University Library Online, *Water in the Middle East*, online at <http://www.columbia.edu/cu/lweb/indiv/mideast/cuvlm/water.html>.

^{cxi} Syria’s Euphrates water is highly contaminated. Due to chemical pollutant and agriculture pesticide runoff, and about 35% loss of water because of cracked pipes, Damascus is frequently without water at night. *Ibid.*

^{cxi} *Ibid.*

^{cxi} United Nations Environment Program website, *GEO:Global Environment Outlook*, online at <http://www.unep.org/GEO/regreports.htm>.

^{cxi} *Ibid.*

^{cxi} *Ibid.*

^{cxi} Oil accounts for 48% of the country’s energy consumption.

^{cxi} Worldwatch Institute website, online at <http://www.worldwatch.org>.

^{cxi} Nearly 2 million cars are over 20 years old and many more are of domestic production with no catalytic converters and poor fuel efficiency. *Ibid.*

^{cxi} Estimates are that 5,000 citizens die every year from air pollution and in the absence of any long-term effective environmental plan, the authorities often close the city to motorists. *Ibid.*

^{cxi} *Ibid.*

^{cxi} The annual evaporation rate ranges from 150-400 cm, while other marine areas (such as the Mediterranean) reach an annual 15 cm evaporation. *Ibid.*

^{cxi} *Ibid.*

^{cxi} Over 60% of the world’s desalinating facilities are in this region. Saudi Arabia desalinates 3 M cu meters of water daily. *Ibid.*

cxxv *Ibid.*

cxxvi United Nations Environment Program website, online at <http://www.unep.org/Documents>.

cxxvii *Ibid.*

cxxviii *Ibid.*

cxxix United Nations Environment Program, *State-of-the-Environment Reports from Africa*, online at <http://www.grida.no/soe/africa>.

cxxx United Nations Environment Program, Earthprint.com, online at <http://www.earthprint.com>. These countries include: Botswana, Burkina Faso, Chad, Ethiopia, Sudan, Kenya, Mozambique, and Mauritania.

cxix *Ibid.*

cxxii United Nations Environment Program website, online at <http://www.Unep.org/documents/default.print.asp>.

cxxiii United Nations Environment Program website, *Africa Environment Outlook*, online at www.unep.org/aeo.

cxxiv John Kamau, *Yes, Let's Review Nile River Treaty*, Daily Nation Online, online at <http://www.nationmedia.com/dailynation/oldarchives>.

cxxv Robert Repetto, *The Second India Revisited: Population, Poverty, and the Environment Stress Over Two Decades*, Washington DC; World Resources Institute.

cxxvi *Ibid.*

cxxvii *Ibid.*

cxxviii *Ibid.*

cxxix *Ibid.*

cxl *Ibid.*

cxli *Ibid.*

cxlii Kurt Kleiner, *Climate Change Threatens Southern Asia*, New Scientist.

cxliii Thomas Homer Dixon, Jeffrey Boutwell, and George Rathjens, *Environmental Change and Violent Conflict*, Scientific America.

cxliv <http://www.sdnep.delhi.nic/resources/environment/news>.

cxlv *Ibid.*

cxlvi *Ibid.*

cxlvii Croaching, suspicious hidden potential by Pamela & Turner.

cxlviii *Ibid.*

cxlix *Ibid.*

cl *Ibid.*

cli *Ibid.*